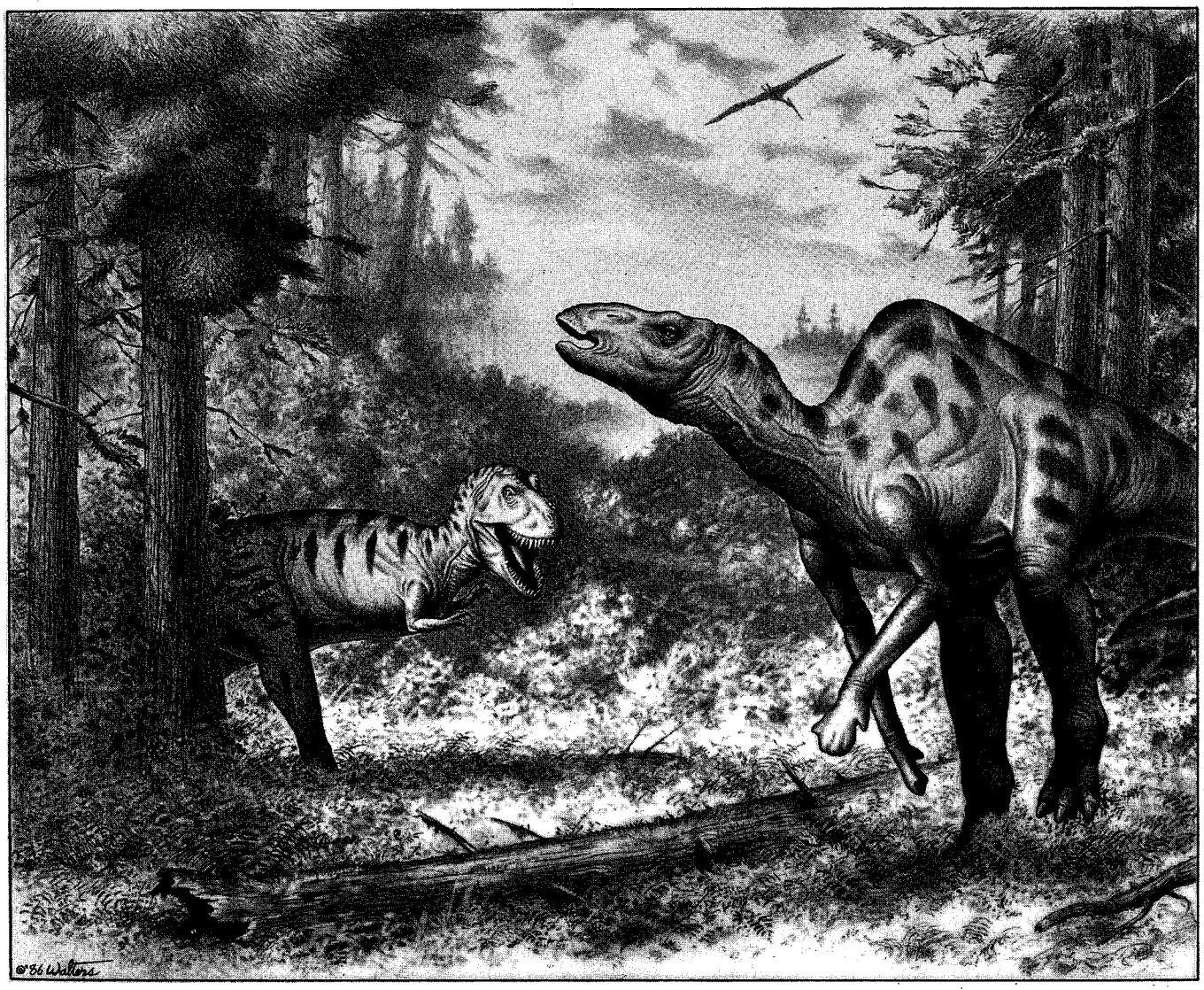
THE MOSASAUR



THE JOURNAL OF THE DELAWARE VALLEY PALEONTOLOGICAL SOCIETY

VOLUME III

NOVEMBER, 1986

The Mosasaur

The Journal of the Delaware Valley Paleontological Society

The Mosasaur is published on an occasional basis by the Delaware Valley Paleontological Society in Philadelphia, Pennsylvania. ISSN 0736-3907.

Additional copies of *The Mosasaur* may be purchased for $15.00. Checks, bank drafts, or international money orders will be accepted only *if payable in U.S. Dollars.* Payment is to be made to the order of the Delaware Valley Paleontological Society, or DVPS. **ORDERS** should be sent to "The Mosasaur", c/o Stephen Farrington, Business Manager, P.O. Box 42078, Philadelphia, PA 19101-2078. **EDITORIAL CORRESPONDENCE** should be sent to William B. Gallagher, Editor, "The Mosasaur", Science Bureau, New Jersey State Museum, 205 W. State St., CN-530, Trenton, NJ 08625.

THE MOSASAUR

The Journal of the Delaware Valley Paleontological Society

Volume III November 1986

Part I: Cretaceous–Tertiary of the Atlantic Coastal Plain

Part II: Other Papers

OSTEOLOGICAL NOTES ON THE FOSSIL TURTLE *?DOLLOCHELYS ATLANTICA* (ZANGERL)

By

David C. Parris, Craig DeTample

Science Bureau, New Jersey State Museum
205 West State Street, CN–530
Trenton, New Jersey 08625–0530

Rachel C. Benton

U.S. National Park Service
Wallpack Center, New Jersey 07881

Introduction

Fragments of toxochelyid turtles are common vertebrate fossils of the Cretaceous System in the Atlantic Coastal Plain. As with many other vertebrate fossils, many taxa were named on the basis of poor specimens during the formative years of vertebrate paleontology in America. Stability of systematics and nomenclature has come slowly. Since the decline of glauconite marl mining, there have been fewer sources of new and better specimens. Biostratigraphic use of the toxochelyids has been virtually nonexistent, due to unstable taxonomy and the fragmentary nature of most specimens.

Fortunately, dozens of amateur and professional collectors are still seeking fossils in the Atlantic Coastal Plain formations. Also, the one remaining commercial glauconite mine, the Inversand Company, is accessible to collectors from the New Jersey State Museum. The kind permission of Churchill Hungerford, Jr., owner of the company, has led to many excellent discoveries. The death of Mr. Hungerford in 1982 was mourned by many paleontologists who benefited from his generosity. His wife, Mabel Hungerford, has graciously continued the contributions to science and to the New Jersey State Museum, by permitting excavation and study at this important locality. In this paper, with the description of yet another fine specimen, an advance in knowledge can be credited to the Hungerford family.

Additionally, we thank Drs. Donald Baird (Princeton University), J. Howard Hutchinson (University of California at Berkeley), and Peter Meylan and Eugene Gaffney (American Museum of Natural History) for useful discussions and review of the manuscript. Charles Smart (Academy of Natural Sciences of Philadelphia) and Mary Ann Turner (Yale Peabody Museum) provided access to specimens in their care. Charles Robbins and Donna Bash assisted in preparation of specimens. William Gallagher (New Jersey State Museum) provided curatorial assistance and stratigraphic information.

The Mosasaur, 3:97–108

Abbreviations used in this report are:

AMNH	American Museum of Natural History
IRSNB	Institut Royal des Sciences Naturelles de Belgique
NJSM	New Jersey State Museum
PU	Princeton University (now part of the Yale Peabody Museum collection)
YPM	Yale Peabody Museum

Previous Studies

Although numerous toxochelyid specimens were described and cited during the early years of American paleontology, the work of Zangerl (1953) was the first publication in which the discovery of numerous well-preserved specimens was combined with a thorough review of all major collections. Zangerl's diagnosis of the Family Toxochelyidae and his proposed division into three subfamilies was the first attempt at reorganization of this important and abundant group of fossil chelonians.

Significant contributions have since added to the knowledge of all three of Zangerl's subfamilies. Baird (1964) reviewed the lophochelyine genus *Peritresius*. Fastovsky (1985) reviewed the Osteopyginae, presenting convincing evidence for transfer of the subfamily to the Cheloniidae. Zangerl (1971) reviewed geologic and geographic aspects of the Toxochelyinae, and described the genus *Dollochelys*.

Of Zangerl's four toxochelyine genera, *Porthochelys* and *Thinochelys* are relatively uncommon taxa of the Niobrara and Mooreville Chalk formations, limited in numbers and range. The majority of specimens of the subfamily are of the genus *Toxochelys*. *Toxochelys* (Coniacian-Maastrichtian) was believed by Zangerl to be ancestral to *Dollochelys* (Maastrichtian-Landenian). It may be expected that adequate study will confirm or disprove this generic sequence.

The species ?*Dollochelys atlantica* has a long and somewhat erratic nomenclatural history, with specimens now attributed to the taxon having been cited previously under various other names (Wieland, 1904; Hay, 1908). The species, now well-defined, is known primarily from the Hornerstown Formation of the Atlantic region. Modifications of both anatomical and range information are now available as a result of specimens reported here.

SYSTEMATIC PALEONTOLOGY

Order CHELONIA

Suborder CHELONIOIDEA

Family TOXOCHELYIDAE Baur

Subfamily TOXOCHELYINAE Zangerl, 1953

Genus *DOLLOCHELYS* Zangerl, 1971

Type species: *Dollochelys casieri* Zangerl, 1971

Diagnosis (Zangerl, 1971): Toxochelyines with elongated carapace—carapace width being less than 90% of total length of the carapace—and with large lateral fontanelles. Maximal width of carapace disc less than 60% of total carapace length. Antero-lateral peripherals very narrow. Average width of pygal smaller than length.

?*Dollochelys atlantica* (Zangerl, 1953)

Lytoloma angusta Wieland, 1904
Lytoloma wielandi Hay (in part), 1908
Toxochelys atlantica Zangerl, 1953
Dollochelys atlantica (Zangerl) Zangerl, 1971
?*Dollochelys atlantica* (Zangerl), this paper

Type specimen: YPM 625, a partial carapace (lacking the anterior portion) and plastron fragments, from the Hornerstown Formation at Barnesboro, Gloucester County, New Jersey.

Hypodigm: Type, and YPM 728, a mandible (Zangerl, 1953) from the Middle Marl Bed at Barnesboro, Gloucester County, New Jersey; NJSM 11055, a partial carapace (Baird, 1964) from the Hornerstown Formation at Birmingham, Burlington County, New Jersey; PU 18709, left peripherals 10 and 11 (Baird, 1964) from the basal Hornerstown Formation at Sewell, Gloucester County, New Jersey, and specimens referred below.

Referred specimens: All are from the Main Fossiliferous Layer of the basal Hornerstown Formation of the Inversand Company Pit, Sewell, Mantua Township, Gloucester County, New Jersey:

NJSM 12295, a nearly complete carapace, partial plastron, a partial right parietal, and fragments of vertebrae

NJSM 12321, partial right hyoplastron and hypoplastron

NJSM 12361, fragmentary left peripherals (possibly sixth, seventh, and eighth)

NJSM 12374, fifth right peripheral NJSM 12375, costal and peripheral fragments

Sewell and Barnsboro (Barnesboro) are neighboring villages in Mantua Township, and practically all specimens come from the basal Hornerstown Formation in that area. The total sample of this species therefore approximates a biological population.

Diagnosis (Zangerl, 1971): Carapace disc measuring about 68% of carapace length (anterior suture of costal 2 to posterior end of pygal). Length of vertebral 3 about 76% of width. Length of suprapygal 1 at midline about 30% of width.

Descriptions: NJSM 12295 is the best preserved specimen yet found of this species. It was discovered by Inversand Company employee Francis Rule and collected by the New Jersey State Museum on 2 July 1975. All bones of the carapace are represented except the sixth peripheral and the diminuitive ninth neural (Figure 1). The anterior portion of the carapace, previously unknown, shows no evidence of post-nuchal fontanelles. Because the specimen is a small and presumably young individual, it appears that the species (and the genus) lacked post-nuchal fontanelles entirely. This aspect was correctly surmised by Wieland (1904) in describing YPM 625 (now the holotype), apparently basing his interpretation on the entire margins of the first costals. In subsequent works Zangerl (1953, 1971) had restored the carapace with hypothetical post-


New Jersey State Museum
Acc. No. 12295
Dollochelys Atlantica Zanger Turtle
D.C. Parris 2 July 1975

nuchal fontanelles, as in all species of Toxochelys for which the anterior carapace is known.

In all general aspects NJSM 12295 and YPM 625 are so similar that the specific identity seems certain. The long oval proportions, great size of the lateral fontanelles, and positions of the costal insertions are the same in both specimens.

The principal difference between NJSM 12295 and YPM 625 is the configuration of the suprapygals (Figure 2). Although cited as a characteristic of specific value (Zangerl, 1971), it appears that the shapes of the suprapygals vary among individuals of this species and cannot be used as diagnostic features. In fact, the suprapygals of NJSM 12295 resemble those of the type specimen of *D. casieri* more than those of the type of ?*D. atlantica*. The fragmentary suprapygals of YPM 625 have been restored to some degree but were probably very similar to the interpretations of previous authors. The suprapygals of NJSM 11055 resemble those of the type specimen. Whether the differences in suprapygals result from age differences, sexual dimorphism, or individual variation cannot be determined without a larger sample.

The neural series of NJSM 12295 generally resembles that of YPM 625, although the latter includes only four actual neural bones, with the rest reconstructed based on the shapes of the costals. The previously unknown first neural differs from the hypothetical shape given by previous authors. It has a straight anterior margin, but the lateral and posterior margins are slightly concave. It is six-sided and contacts the second costals. The second neural, also previously unknown, resembles the same bone in *D. casieri*, but is even more completely rectangular (40 mm by 26 mm) with both ends slightly convex.

In view of the considerable variation in the suprapygals, much variation in the posterior neurals might also be expected. In YPM 625 the posterior neurals are missing, but Wieland (1904) deduced that the posterior sulcus of the fourth vertebral scute crossed the ninth neural. The ninth neural is also missing from NJSM 12295, but it appears that the sulcus indeed must have crossed it. It was a diminuitive bone, apparently. The sulcus crosses the eighth neural in *D. casieri*. It is doubtful whether these observations have any value in species recognition, being more likely due to individual variation.

Cross-sections of the peripheral bones (Figure 3) show resemblance to those of YPM 625 (Wieland, 1904).

The plastron of NJSM 12295 is represented primarily by the right hyoplastron, which differs only slightly from that which was illustrated by Zangerl (1971) for *D. casieri*. The xiphiplastron apparently was much different in the two species. The right xiphiplastron, preserved in NJSM 12295, has an external margin which is almost straight, in contrast to IRSNB 1631, the type of *D. casieri*, in which it has an obtuse angle in ventral view.

Figure 1. Photograph of NJSM 12295 partially assembled showing portions represented: carapace, plastron fragments, and parietal. (Some peripheral bones displaced from proper positions.) New Jersey State Museum photograph by S. Donald Weeks. Approximate length is 53 cm.

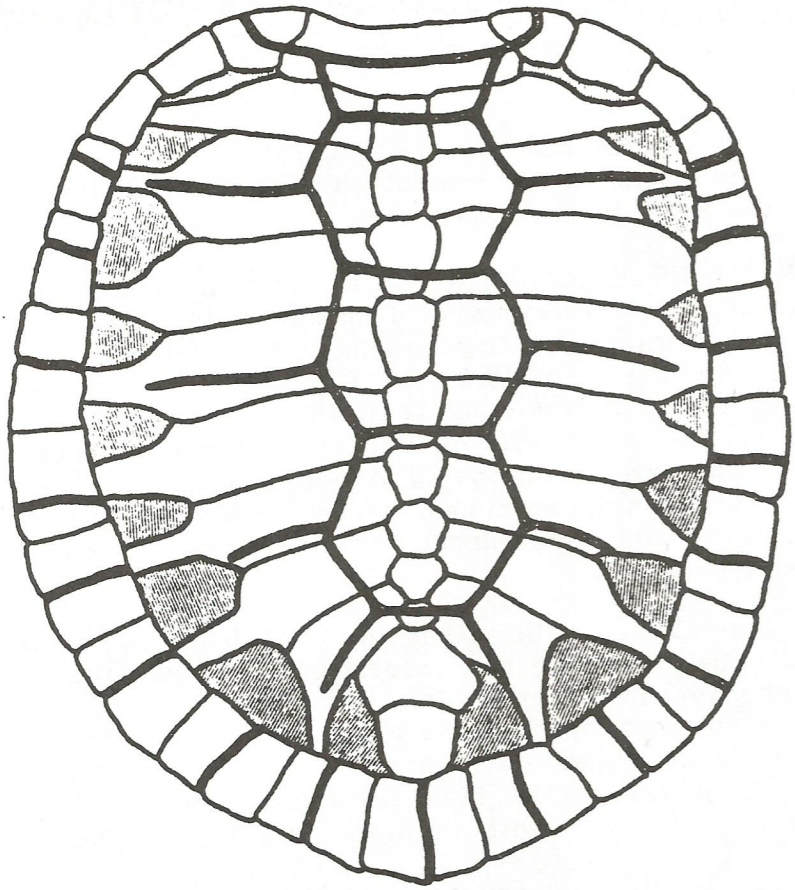


Figure 2. Outline drawings of carapace of ?D. atlantica based on NJSM 12295. Drawing by Allan Thomas.

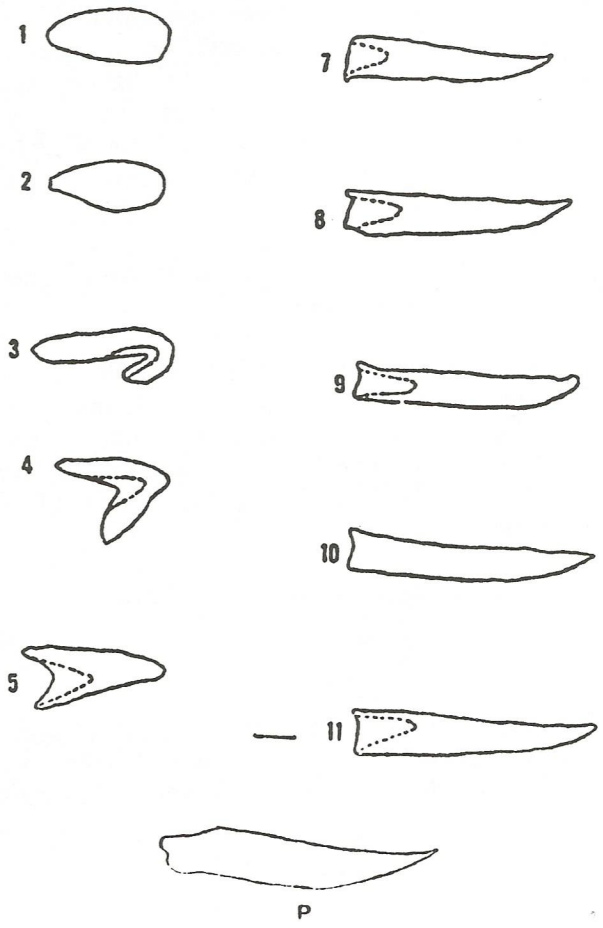


Figure 3. Outline of cross-sections of left peripherals and pygal of NJSM 12295. Broken lines show maximum depths of costal insertions. Line indicates one centimeter.

The plastron of YPM 625 was barely mentioned by Wieland (1904) and has not been subsequently described. The portions represented by YPM 625, NJSM 12295, and NJSM 12321 can be considered together to give a rather good description of the plastron (Figure 4). Most of Zangerl's hypothetical reconstruction of the plastron of *D. casieri* resembles that of ?*D. atlantica*, except for the shape of the xiphiplastron, which may be a valid species distinction. However, the central plastral fontanelle must have been relatively small in ?*D. atlantica* because the midline is closely approached by all three specimens with no evidence of the fontanelle margins showing. It was probably much

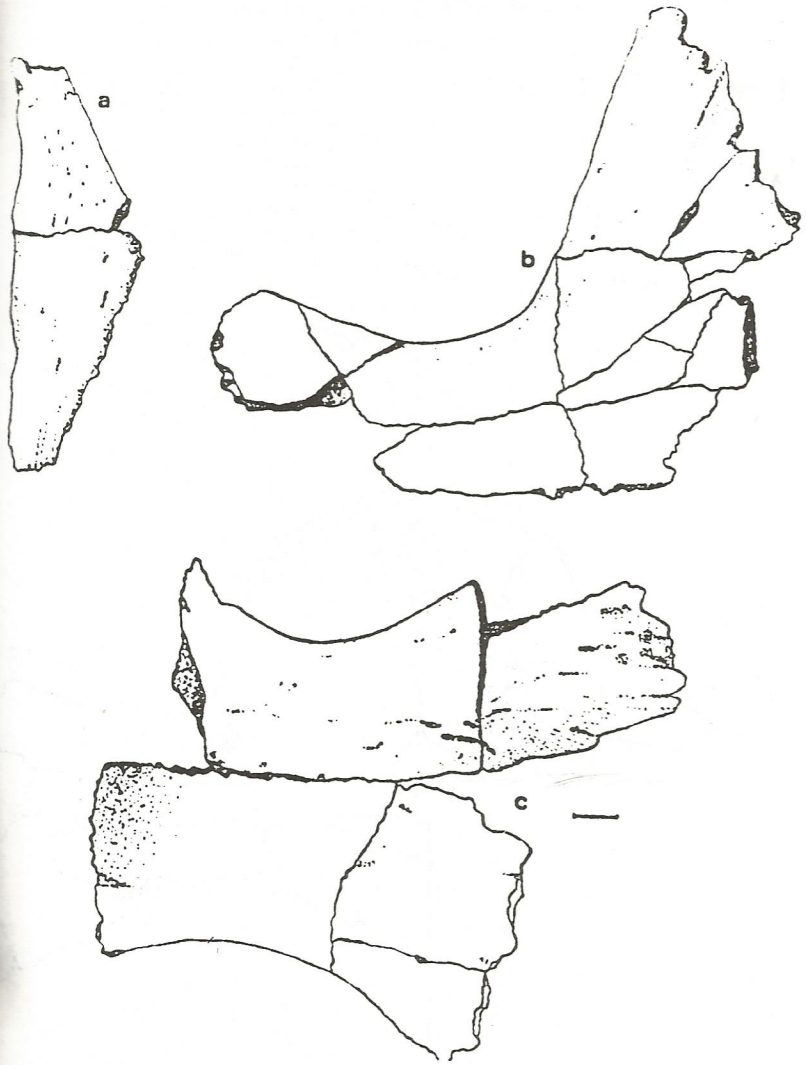


Figure 4A. Plastron fragments of ?D. atlantica. a, right xiphiplastron NJSM 12295; b, right hyoplastron of NJSM 12295; c, hyoplastron and hypoplastron NJSM 12321. Line indicates one centimeter.

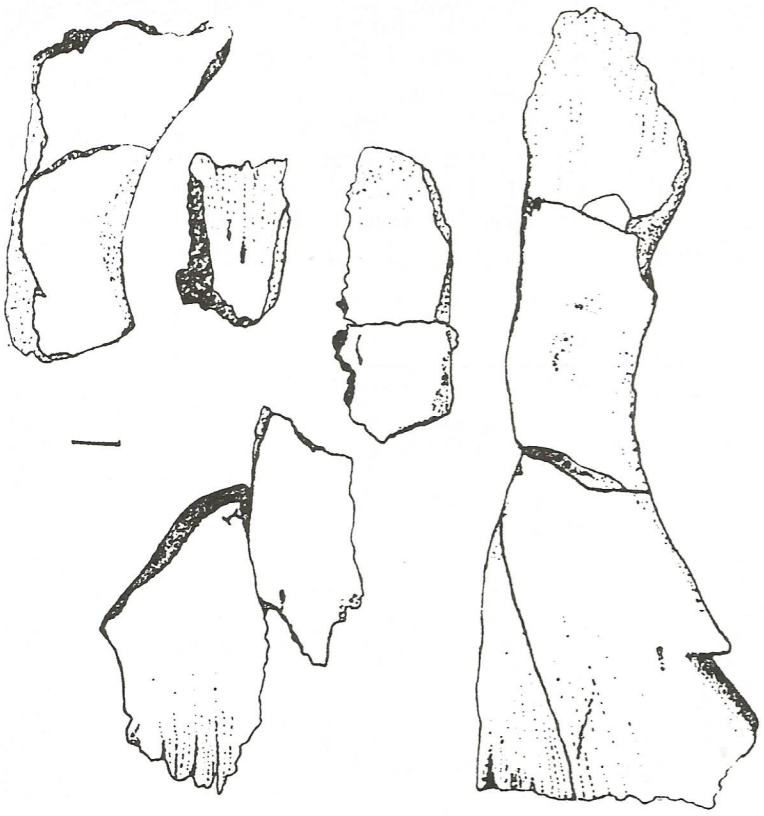


Figure 4B. Plastron fragments of type of ?D. atlantica, YPM 625. Line indicates one centimeter.

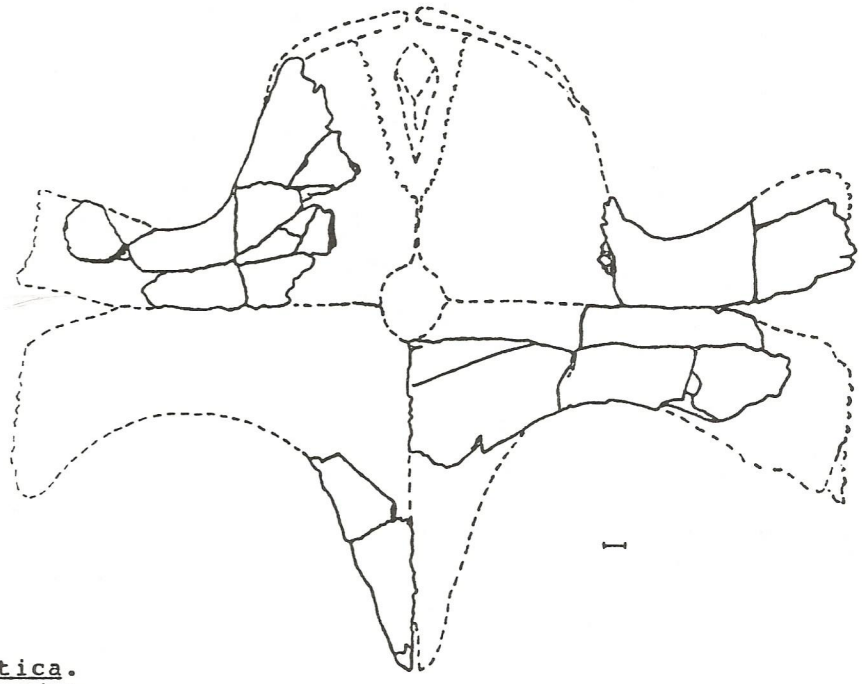


Figure 4C. Plastron of ?D. atlantica. Composite view based on all specimens. Line indicates one centimeter. Drawing by Allan Thomas.

smaller than the fontanelle hypothesized by Zangerl (1971) for *D. casieri*. Of the epiplastron and entoplastron nothing is yet known.

The parietal fragment of NJSM 12295 is the first skull element reported for the species. As might be expected, it is generally similar to that element in *Toxochelys*, as represented in AMNH 5118, for example.

The association of a parietal fragment in NJSM 12295 permits the referral of yet another skull fragment, NJSM 11254, to the Family Toxochelyidae. Although generic identification may not be possible the latter specimen is of interest for several reasons. It shows considerable cranial morphology, including the left parietal, frontal, and prefrontal (Figure 5), and the cranial sulci. Also it comes from the Upper Fossiliferous Layer at the Inversand Company, and thus is of Danian age (Parris, 1986). It is sufficiently similar in all views to the parietal of NJSM 12295 as to appear generically identical to *Dollochelys*. It is from a rather large skull and resembles that of *Toxochelys*, as illustrated by Gaffney (1979). The anterior process of the frontal is relatively longer and more slender, approaching the narial area. There is no evidence of a nasal bone and it may have been absent from the margin of the narial opening.

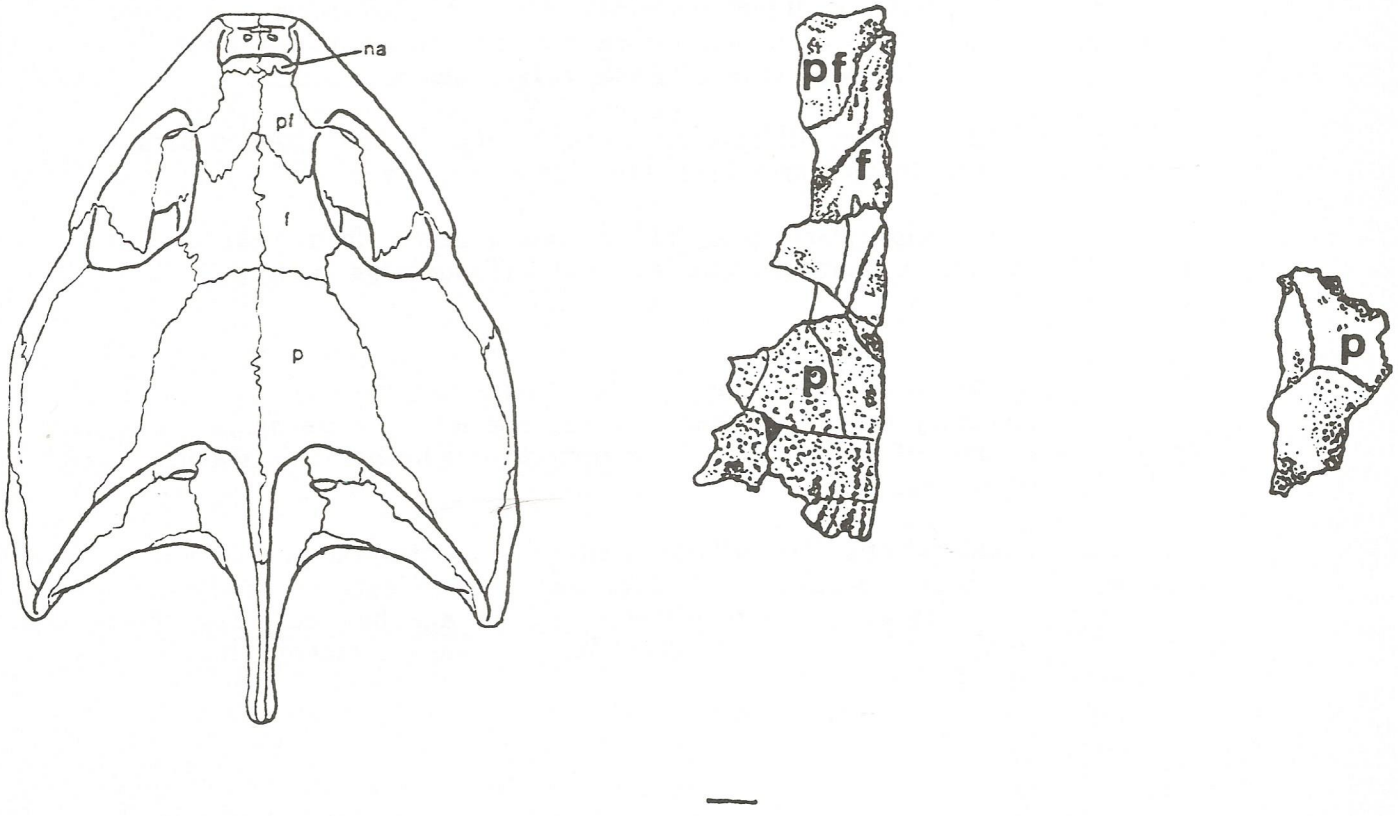


Figure 5. Skull of *Toxochelys* as shown by Gaffney (1979), compared with NJSM 11254 and parietal fragment of NJSM 12295. Lines indicate centimeter; n – nasal; p – parietal; f – frontal; pf – prefrontal.

Although we can offer no new information on the mandible of *D. atlantica*, we note that specimens previously have been referred to both species of the genus. Zangerl (1953) tentatively referred YPM 728 to *D. atlantica*. He also described a mandible as part of IRSNB 1631, the holotype of *D. casieri* (Zangerl, 1971). There is no reason to doubt the association of the mandible with the Belgian specimen. *Dollochelys* apparently had a mandible much different from that of *Toxochelys* (Gaffney, 1979), with a longer symphysis and relatively deeper occlusal area. Unfortunately the mandible of *D. casieri* is much different from YPM 728, which was tentatively referred to ?*D. atlantica* (E. Gaffney, personal communication). Nothing is known for certain about the mandible of *D. atlantica*.

A specimen cited by Baird (1964), NJSM 11055, is of interest primarily because of its size. It consists of little more than ten fragmentary costals and seven peripherals. It is crudely mounted in plaster, but the carapace size seems to be accurately reconstructed. It is about 760 mm long, considerably bigger than the other referred materials. Its identity is not in doubt, and it is indicative of the range of variation which may be expected for the species. As previously noted, it also has suprapygals which resemble those of YPM 625.

Taxonomic Assignment of the Species

In addition to the discussion of Zangerl (1971), in his assignment of ?*D. atlantica* to *Dollochelys*, the following points of evidence are worthy of note:

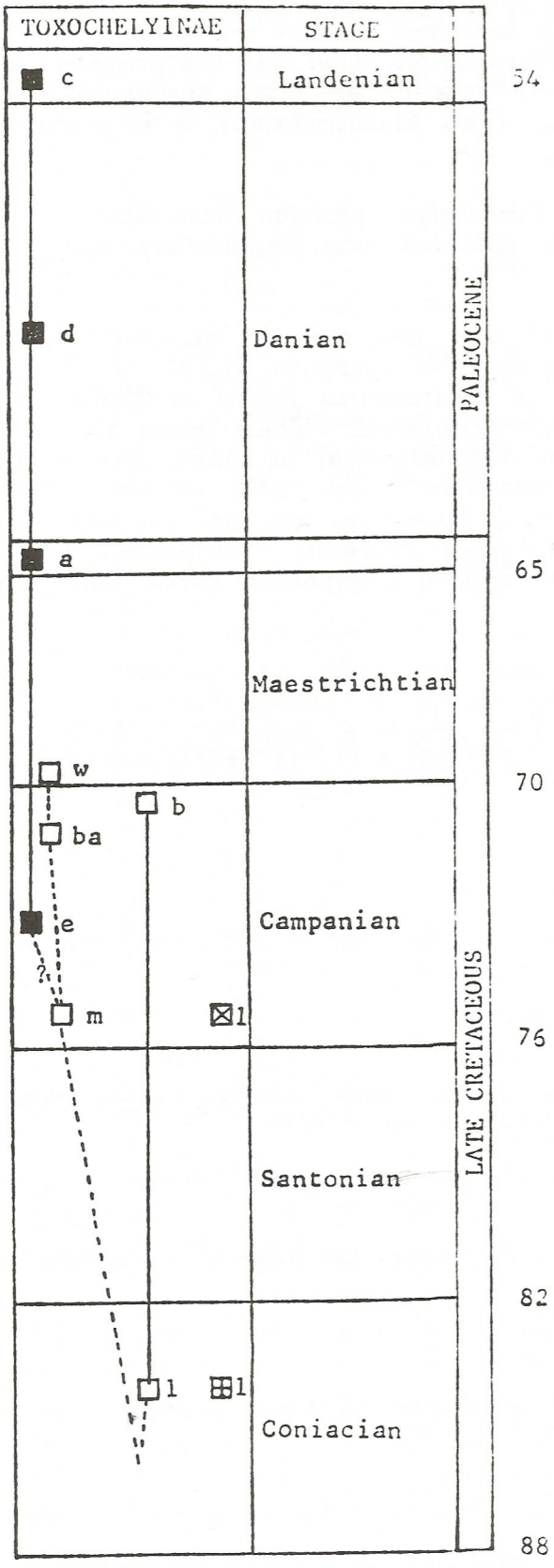
1. The species ?*D. atlantica* differs from all species of *Toxochelys* for which the anterior carapace is known in the absence of post-nuchal fontanelles. It is unknown whether this was true of *Dollochelys casieri*.

2. ?*D. atlantica* differs from all species of *Toxochelys* in the absence of a costal insertion from the tenth peripheral. In this feature it resembles *D. casieri*.

3. The shape of the xiphiplastron of ?*D. atlantica* differs from that of *D. casieri*. It resembles that of some species of *Toxochelys* (*i.e.*, *T. moorevillensis*).

4. The shape of the first neural bone in ?*D. atlantica* (six-sided, and contacting the second pleurals) resembles that of some species of *Toxochelys*. The same probably was true of *D. casieri*. It is uncertain whether this feature has much taxonomic value.

In view of these considerations, ?*D. atlantica* should be retained provisionally in the genus *Dollochelys*, which it best resembles. It does have some features in common with Campanian species of *Toxochelys* and also is intermediate in age between *Toxochelys* and *D. casieri*. The species may in fact indicate that Zangerl was correct in his belief that *Toxochelys* is the ancestor of *Dollochelys*. In that case there could be biostratigraphic value to be gained by continued study of the subfamily.



Key:

- w — Toxochelys weeksi
- ba — Toxochelys barberi
- m — Toxochelys moorevillensis
- l — Toxochelys latiremis
- b — Toxochelys browni
- a — ?Dollochelys atlantica
- c — Dollochelys casieri
- d — cf. Dollochelys
- e — Dollochelys?
- l — Thinochelys lapisossea
- l — Porthochelys laticeps

Figure 6. Revised ranges of toxochelyin turtles, depicted in style of Zangerl (1971)

The Ranges of Toxochelyines

It has been supposed that *Toxochelys* was the ancestor of *Dollochelys* and that the transition between the genera was completed during the early Maastrichtian (Zangerl, 1971). However, few specimens are available to document the transition. As noted by Baird (1964) the basal portion of the Hornerstown Formation was the provenience for the most and best specimens of *?D. atlantica*. In view of the many specimens which have been collected from the Navesink Formation (also Maastrichtian) it is surprising that toxochelyines have not been reported from it.

Baird & Galton (1981) reported a *Toxochelys* specimen from the Merchantville Formation of Delaware (PU 21687), but the specimen was fragmentary and yielded no substantial information.

An interesting specimen of Campanian age was recently discovered by Michael Bernstein, a Philadelphia amateur paleontologist. The specimen, NJSM 12757, was found in the Woodbury Formation near the site of *Hadrosaurus foulkii* in Haddonfield, New Jersey. It consists of the fourth and fifth left peripherals. These bones are very similar to the same bones in YPM 625 (the type of *?D. atlantica*) in shape, cross-section, and sulcus positions. Resemblances to the same bones in NJSM 12295 are also good. Direct comparisons to the same bones in specimens of *Toxochelys* are difficult, since the latter come from formations where preservation is much different. Peripherals may not be diagnostic of the genera; however, the presence of a Campanian turtle indistinguishable from *?D. atlantica* is of interest.

Dollochelys casieri is from the Landenian Stage, now generally regarded as Late Paleocene. Some fragmentary toxychelyine specimens are known from the Landenian of North America, such as NJSM 13522, a left third peripheral from the Aquia Formation of Virginia. The zoogeographical distributions by Zangerl (1971) are therefore in need of revision. (See Figure 6.)

References Cited

BAIRD, Donald. 1964. *A fossil sea turtle from New Jersey.* New Jersey State Museum Investigations, no. 1, pp. 3–26, 9 figs.

BAIRD, Donald, & P. M. GALTON. 1981. Pterosaur bones from the Upper Cretaceous of Delaware. *Journal of Vertebrate Paleontology*, 1(1):67–71, 3 figs.

FASTOVSKY, David E. 1985. *A skull of the Cretaceous Chelonioid turtle* Osteopygis *and the classification of the Osteopyginae.* New Jersey State Museum Investigations, no. 3, pp. 3–28, 6 figs.

GAFFNEY, Eugene S. 1979. Comparative cranial morphology of recent and fossil turtles. *American Museum of Natural History, Bulletin*, 164 (article 2): 67–376, 273 figs.

HAY, Oliver P. 1908. *The fossil turtles of North America.* Carnegie Institution of Washington, Publication 75, 568 pp., 704 figs., 103 pls.

PARRIS, David C. 1986. *Biostratigraphy of the fossil crocodile* Hyposaurus *Owen from New Jersey.* New Jersey State Museum Investigations, no. 4, 16 pp., 1 fig.

WIELAND, George R. 1904. Structure of the Upper Cretaceous turtles of New Jersey; *Lytoloma*. *American Journal of Science*, Ser. 4, 18:183–196, 6 figs., 4 pls.

ZANGERL, Rainer. 1953. The vertebrate fauna of the Selma Formation of Alabama, Part IV, The turtles of the Family Toxochelyidae. *Fieldiana; Geological Memoirs*, 3(4):137–277, 64 figs., 20 pls.

———. 1971. *Two toxochelyid sea turtles from the Landenian Sands of Erquelinnes (Hainaut) of Belgium.* Institut Royal des Sciences Naturelles de Belgique, Memoire 169, 32 pp., 18 figs., 9 pls.